

USE OF FARM MACHINERY FOR CORN-BORER
CONTROL IN THE ONE-GENERATION AREA¹By R. M. MERRILL, *agricultural engineer, Division of Mechanical Equipment,
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INTRODUCTION

The most practical and effective methods of controlling the European corn borer are considered to be those which destroy the borer-infested corn plants or treat those plants in such a way that they can no longer furnish shelter for the borers. To a great extent, these methods involve mechanical treatment of the corn plant. The principal advantages of these mechanical methods are that one or more of them can be used in most cases regardless of the size of field or method of harvesting the corn crop. That method of mechanical control should be chosen which will best fit into the general farming practice and which can be carried on, to a great extent at least, with available tools and machinery.

In order to apply any control method effectively, a clear understanding of the life history of the European corn borer is important. In the western or 1-generation area of infestation in the United States, the borers hatch from eggs laid during late June, July, and early August, and after a few days feeding on the leaves of the corn plant they bore into the stalk. They remain in the stalk, feeding at intervals until cold weather stops their activities in October or November, and during the winter remain dormant in their tunnels in stalks, cobs, and other plant remnants. When warm weather arrives in April or May the borers become active, and in late May or early June they go into the pupa stage from which the adult borers emerge in 10 to 14 days as moths. Soon after emergence, the moths mate and the females begin to lay eggs, usually in masses of from 15 to 20 eggs each, on the under sides of the corn leaves.

¹ According to a survey made 2 years ago the 1-generation area of European-corn borer infestation comprised nearly all of New York, Pennsylvania, and Ohio and portions of Michigan, Indiana, Wisconsin, West Virginia, and Kentucky. In this area the borers complete only one life cycle in a year. In New England, the eastern end of Long Island, eastern New Jersey, and the Eastern Shore of Maryland and Virginia the borers complete two generations in a year. Methods of controlling this pest in the latter regions are described in Circular 132, *Fighting the Corn Borer with Machinery in the Two-Generation Area*.

Since nothing has been found for effectively controlling the European corn borer when it is in the moth stage, all control methods must be used when the borer is in the worm or larval stage of its life cycle. As stated above, this worm or larval stage in the 1-generation type of borer extends from the middle of summer to the following May or June, thus giving opportunity for destroying the insect in the corn-plant remnants after the corn crop is harvested.

METHOD OF CONTROL TO USE

In the western area of corn-borer infestation probably the most important factor determining the method of control is the manner in which the corn crop is harvested. In this area most of the corn is harvested either by picking the ears, by hand or by machine, from the standing stalks in the field; or by removing the stalks, including the ears, and ensiling the material, shredding it, or feeding it as shock corn or stover to livestock.

Since the major portion of the corn crop is harvested by the first-named practice, leaving the stalks in the field, the mechanical methods of corn-borer control adapted to this practice will be discussed first. As previously pointed out, the corn-borer larvae or worms are within the cornstalks at harvest time, and if left undisturbed will continue to live in the stalks until they emerge in the spring as moths. To kill the borers, these stalks must either be destroyed or treated in such a manner that they can no longer shelter the borer.

PLOWING AS A CONTROL MEASURE ²

Where farming practices and field conditions permit, probably the best method of handling the standing stalks is to plow them under deeply and cleanly. Many of the borers in the stalks thus buried will, if the weather is favorable, come to the surface of the soil to seek other shelter, but if no cornstalk or weed remnants are available on the surface, the borers will perish from exposure or will be killed by birds or other natural enemies. However, if all plant material and debris is not buried by the plowing operation, the effectiveness as a control measure is largely lost, since it requires only a small amount of uncovered material to shelter a large number of borers and enable them to complete their life cycle and reproduce. The debris should be buried as deeply as possible so that it will not be brought to the surface by subsequent tillage operations or by weathering.

To obtain good coverage of all stalks and plant material more than ordinary care must be exercised in the plowing operation. To insure effectiveness, the following points must be considered:

1. The plow must have ample clearance under and between the beams to allow cornstalks and trash to pass through the plow without clogging. Sufficient adjustments should be provided to permit the plow to be operated to the best advantage. Plow bottoms should be large enough to turn all trash into the furrow and cover it completely with soil. In most soil conditions good coverage of trash is more easily obtained with a wide-bottom than with a narrow-bottom plow.

² Very complete information on plows and plowing as related to corn-borer control may be found in Farmers' Bulletin 1690, *Plowing with Moldboard Plows*, which may be secured from the Superintendent of Documents, Washington, D.C., at 5 cents a copy.

2. Good coverage of trash is almost impossible in most conditions unless some type of attachment to aid the plow is used. The most important of these attachments now available are the rolling colter and jointer. The rolling colter should be of at least 15-inch diameter; 18-inch is much better, since the smaller colters have difficulty in

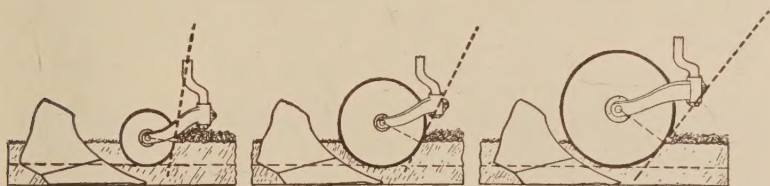


FIGURE 1.—Large colters can mount trash more readily than small ones.

mounting and cutting trash (fig. 1). A walking plow in many conditions has difficulty in covering heavy trash because the plow is not heavy enough to force a rolling colter through heavy cornstalks or other growth. Where this condition exists some method of removing or breaking up stalks previous to plowing should be used. The jointer is necessary to move the trash and a small amount of surface

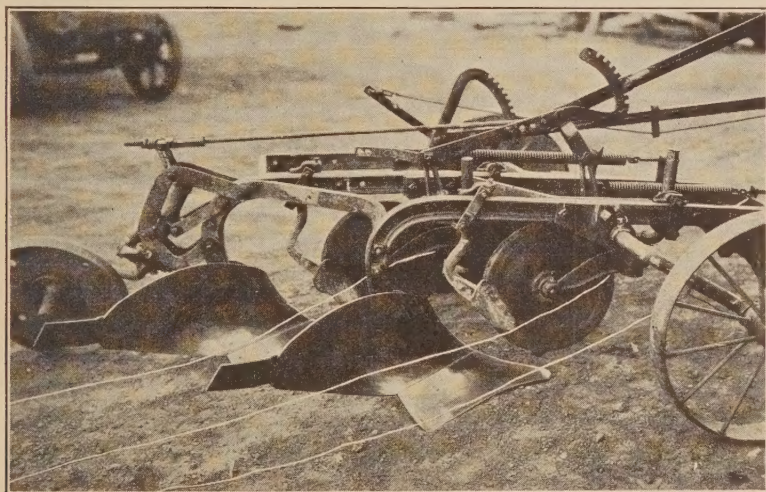


FIGURE 2.—Covering wires attached to plow.

soil at the outer edge of the furrow slice toward the open furrow. This insures deeper coverage of the trash by the turning furrow slice.

Covering wires, attached to the colter shank or to the plow axle and trailing back under the turning furrow slice, hold stalks and trash in position against the surface of the furrow slice while it is being inverted (fig. 2).

Trash guides of various types have been designed for use in covering trash and, although more expensive than the covering wires, they give better results in most conditions (figs. 3 and 4).

3. The plow should be adjusted to its normal operating position, i.e., the bottom, or bottoms if a gang plow, should run level with



FIGURE 3.—Plow with trash guides for covering heavy growth of stalks.

each bottom cutting its normal width. The depth should be sufficient, usually 6 to 8 inches, to insure the complete burial of trash and to

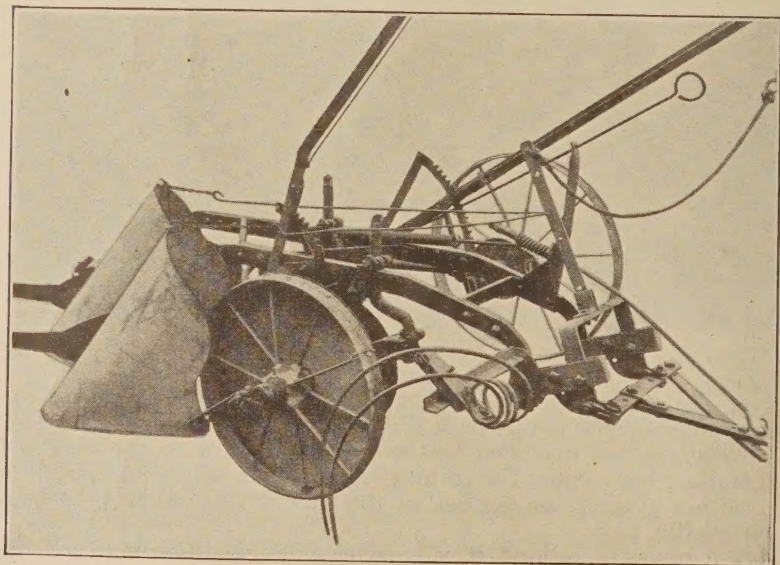


FIGURE 4.—Plow fitted with trash guides and hooks to drag stalks into furrow.

prevent subsequent tillage operations or weathering from bringing the trash to the surface. The plow should be operated at a speed

which will enable the moldboard to turn the soil completely over the trash in the open furrow.

4. Where conditions are such that good coverage cannot be obtained with the available plow equipment, one or more of the following practices frequently can be carried out to assist in securing the desired results. Cut or break the stalks on the headlands and at the locations for the back furrows with a stalk shaver, railroad rail, or log, and rake and burn them before striking out the plow lands. If the corn has been picked by machine, plow in the direction the stalks are leaning. Before

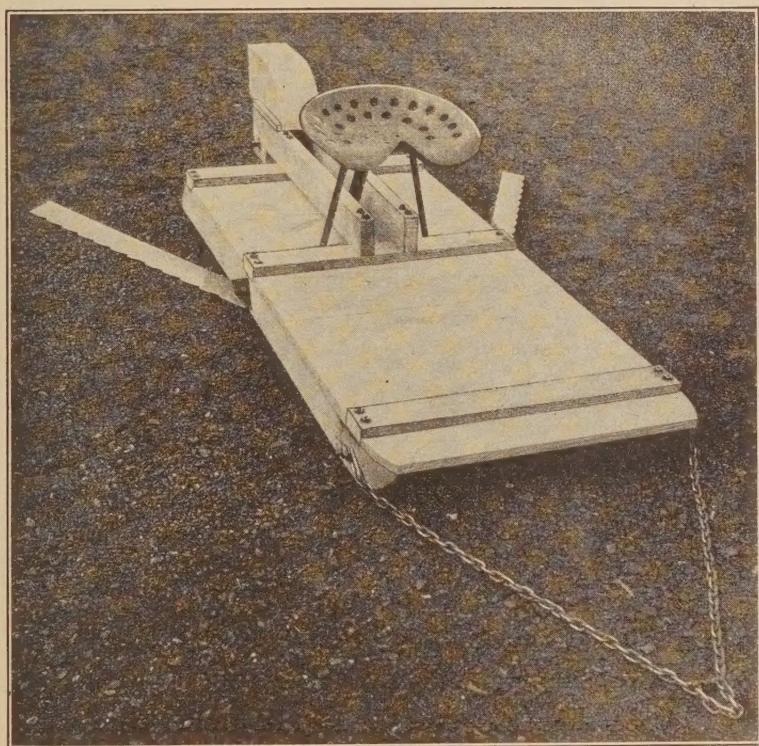


FIGURE 5.—Sled-type cornstalk shaver.

attempting to plow, disk or roll the stalks in the direction in which the plow will travel. This will give the greatest benefit if the disking or rolling is done as long as possible before plowing.

DESTRUCTION OF STANDING STALKS AFTER THE CORN IS HARVESTED

When weather, soil conditions, or general farming practices do not permit plowing cornstalk land, the stalks may be removed and destroyed by cutting, raking, and burning, thus killing the borers contained in the stalks. These operations are usually carried on in the spring as soon as soil and weather conditions are favorable. The stalks are often broken off in the winter when frozen, by dragging a heavy log or railroad rail across the field, but it has been found in

most seasons there are only a few days when conditions are favorable for this method to give good results. The stalks can be detached more effectively by cutting them in the spring with some type of stalk shaver. Several types of shavers have been constructed for this work and instructions for building the sled-type shavers (fig. 5) are available (Miscellaneous Publication 142, Construction of Sled-Type Cornstalk Shavers).

Special cornstalk dump rakes with closely spaced teeth (fig. 6) can be purchased, and give much better results than the standard dump rake commonly used for hay, but in many cases even these special rakes do not gather all the stalks. A special side-delivery rake having four rake bars and closely spaced teeth (fig. 7) which sweep the ground very cleanly is now manufactured and, although

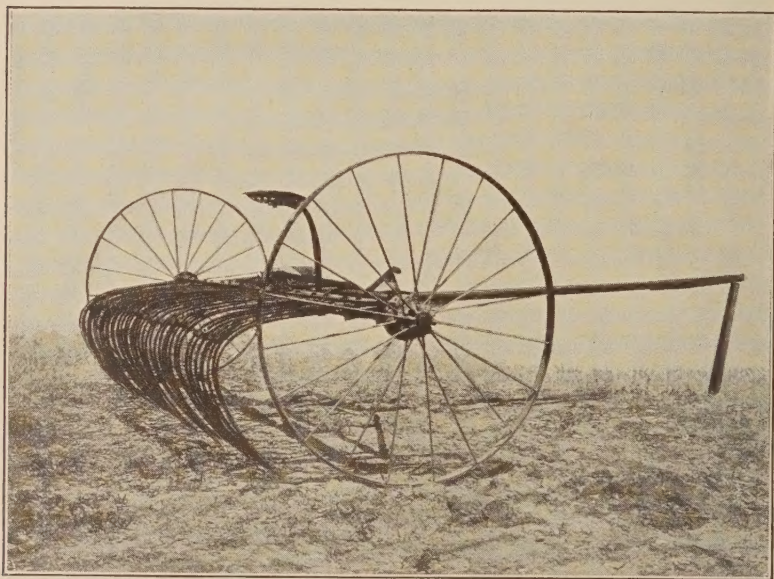


FIGURE 6.—Close toothed dump rake for gathering cornstalks.

requiring more time and power for the operation than the dump rake, will give satisfactory results under most conditions.

After the stalks are raked into windrows, care must be taken to burn the material as completely as possible, making sure that all stalk remnants remain in the fire a sufficient length of time to kill any contained borers. It is usually necessary to gather the unburned portions of the windrows with the rake and fire them again to obtain a clean field. Some hand work is also usually necessary to get all stalks into the fire.

METHODS OF CONTROL WHEN STALKS ARE REMOVED FROM FIELD

That portion of the corn crop which is harvested by cutting the stalks and removing them from the field for ensiling, shredding, or feeding as whole stalks to livestock, may be handled in any one of several ways to secure satisfactory corn-borer control. To eliminate

those corn borers which are in the lower portions of the stalks the corn must either be cut at the ground surface or the stubble destroyed in some way or plowed under.

Attachments which cut the cornstalks at the ground surface have been devised and are available from manufacturers for standard corn binders (fig. 8). Binders with these attachments have been tested in many different areas and have given very satisfactory results.

The low-cutting attachment for the binder consists essentially of (1) a long stationary knife set a short distance ahead of the regular sickle, to cut the stalks at the ground surface; (2) an elevating chute to lift the stalks so they will not be recut by the sickle; and (3) an extension butt-gatherer chain and extra throat springs to grasp the



FIGURE 7.—Special four-bar side rake gathering cornstalks.

stalks as they are cut and carry them into the machine. The regular sickle cuts weeds and grass to prevent the throat of the binder from becoming clogged. Complete information on the construction of the low-cutting attachments for corn binders is found in Miscellaneous Publication 56, *Low-Cutting Devices for Harvesting Corn*.

Several types of sled corn cutters with low-cutting knives have been devised for use where field conditions, acreage of corn, or other factors do not permit the use of the corn binder. These cutters (fig. 9) consist of a low sled to be drawn between the corn rows by a single horse. Knives which cut off the corn at the ground surface are attached to the side of the sled. The operator, or operators, if two rows of corn are being cut, stand on the sled to catch the corn as it is cut. A plow colter disk is attached to the rear of the sled to give stability.

If corn is cut by hand it should be cut at the ground surface and several types of knives or hoes have been developed for this operation (fig. 10).



FIGURE 8.—Corn binder with low-cutting attachment leaves practically no stubble.

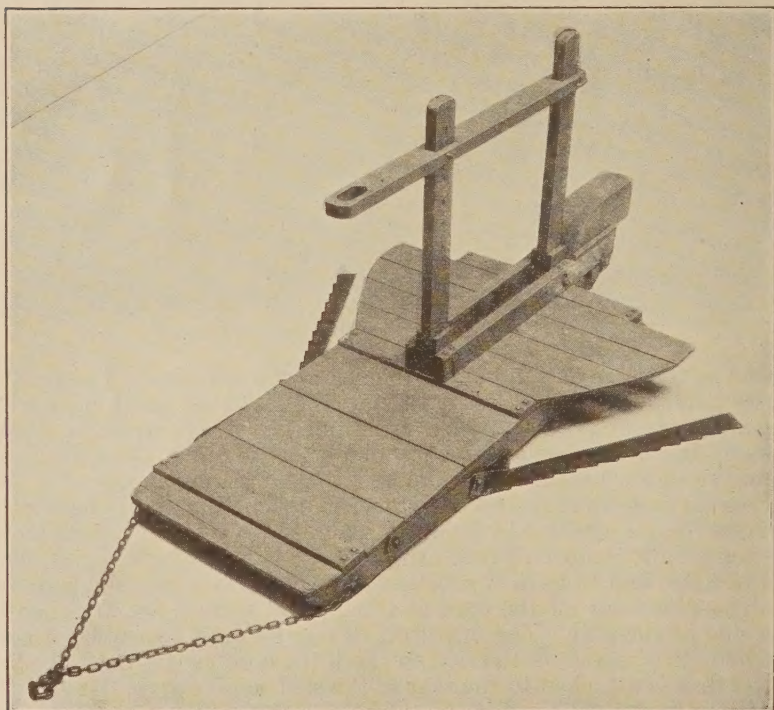


FIGURE 9.—Sled type corn cutter for cutting corn to be shocked.

After the corn has been cut at the ground surface by one of the above-described methods, the corn borers contained in the stalks may be killed by observing the following suggestions:

If stalks are put into a silo as silage, the silage cutter should be adjusted to cut the material in lengths of not more than one-half inch. The cutting of the stalks and the fermenting action in the silo will prevent the survival of any borers not killed by the silo filler.

Tests have shown that if stalks are put through a properly adjusted husker-shredder, 95 to 98 percent of the borers in the stalks will be killed. Those borers surviving the action of the machine will probably die from being fed to livestock, trampled in manure in the feeding yard, or from the drying of the cut material if in storage. Farm-

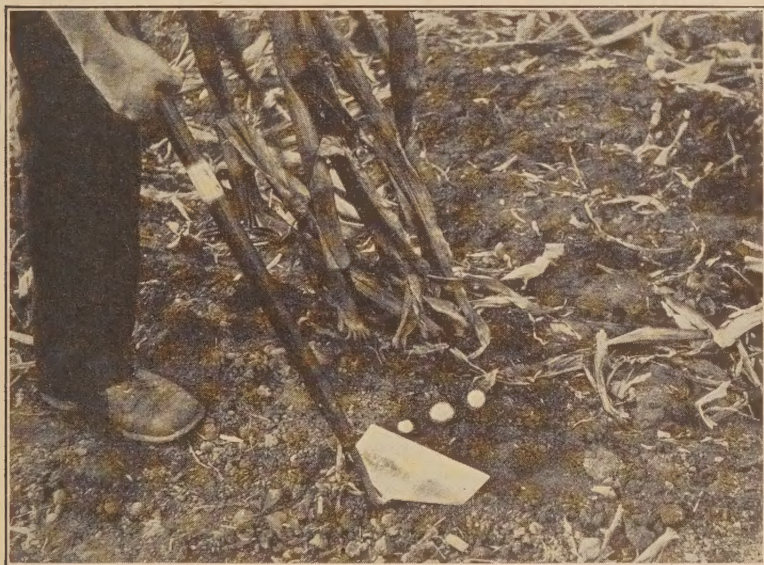


FIGURE 10.—Hand hoe for cutting corn at ground surface.

ers' Bulletin 1662, *Husker-Shredders in Corn-Borer Control*, gives more detailed information on the use of this machine.

If the corn is neither ensiled nor shredded, but is fed to livestock as it comes from the shock, there is danger that many borers will survive in the portions of stalks not consumed by the animals. The borers in stalks which are trampled into manure in the feed yard will very probably die before emerging, but stalks left on the surface of the feed lot should be gathered and burned before time for the moths to emerge. (See Circular 194, *Manure Piles and Feed Lots as Sources of European Corn Borer Reinfestation*.)

OTHER DEVICES USED FOR MECHANICAL CONTROL

Putting cornstalks through roughage mills or feed grinders is an effective control measure if the material is ground fine enough to insure destruction of the borers.

For destroying small amounts of infested material, incinerators have been used. These, however, are not applicable to any large field operations.

Large portable field burners have been used when a quick cleanup was desired, but this method is too costly for general use.

GENERAL SUGGESTIONS

Regardless of which mechanical method is used in the control of the European corn borer, it can readily be seen from a knowledge of the habits of the insect that to obtain efficient control considerable care must be taken to insure the destruction of the greatest possible number of the larvae. Like many other insects, the European corn borer has the ability to reproduce very rapidly and a relatively few borers surviving one season may produce a dangerous number the following season.

One of the greatest aids to efficient control by mechanical methods—plowing, shaving, and raking, or low cutting—is the practice of level cultivation of corn. A cornfield left excessively ridged by cultivation is difficult to plow or rake cleanly, and also handicaps somewhat the low-cutting harvesting machinery. Slightly ridged corn, however, does not offer these difficulties.

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